DMTS Fugitive Dust Risk Assessment Volume I—Report

Draft

The first set of pages, including the Table of Contents and the Executive Summary, have been separated by ADEC in this file from Exponent’s original document for ease of downloading via the Internet.

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Teck Cominco Alaska Incorporated
Anchorage, Alaska
DMTS Fugitive Dust
Risk Assessment
Volume I—Report
Draft

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## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Figures</td>
<td>vii</td>
</tr>
<tr>
<td>List of Tables</td>
<td>x</td>
</tr>
<tr>
<td>List of Photographs</td>
<td>xv</td>
</tr>
<tr>
<td>Acronyms and Abbreviations</td>
<td>xviii</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>xx</td>
</tr>
<tr>
<td>1 Introduction</td>
<td>1-1</td>
</tr>
<tr>
<td>1.1 Site Overview</td>
<td>1-1</td>
</tr>
<tr>
<td>1.2 Document Organization</td>
<td>1-2</td>
</tr>
<tr>
<td>2 Preliminary Conceptual Site Model</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1 Sources of Chemicals</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1.1 Ore Concentrates</td>
<td>2-1</td>
</tr>
<tr>
<td>2.1.2 Petroleum Hydrocarbons and Other Spills</td>
<td>2-1</td>
</tr>
<tr>
<td>2.2 Transport and Fate of Chemicals</td>
<td>2-4</td>
</tr>
<tr>
<td>2.2.1 Road</td>
<td>2-4</td>
</tr>
<tr>
<td>2.2.2 Port</td>
<td>2-5</td>
</tr>
<tr>
<td>2.2.3 Mine Vicinity</td>
<td>2-6</td>
</tr>
<tr>
<td>2.2.4 Fugitive Dust Control Measures</td>
<td>2-7</td>
</tr>
<tr>
<td>2.3 Preliminary Human Health Conceptual Site Model</td>
<td>2-8</td>
</tr>
<tr>
<td>2.3.1 Environmental Setting</td>
<td>2-9</td>
</tr>
<tr>
<td>2.3.2 Potential Receptors</td>
<td>2-11</td>
</tr>
<tr>
<td>2.3.3 Potential Exposure Pathways</td>
<td>2-13</td>
</tr>
<tr>
<td>2.4 Preliminary Ecological Conceptual Site Model</td>
<td>2-18</td>
</tr>
<tr>
<td>2.4.1 Site Description</td>
<td>2-19</td>
</tr>
<tr>
<td>2.4.2 Sensitive Species</td>
<td>2-21</td>
</tr>
<tr>
<td>2.4.3 Sensitive Environments</td>
<td>2-22</td>
</tr>
<tr>
<td>2.4.4 Potential Exposure Pathways</td>
<td>2-22</td>
</tr>
<tr>
<td>2.4.5 Potential Receptors</td>
<td>2-23</td>
</tr>
<tr>
<td>2.4.6 Preliminary Assessment and Measurement Endpoints</td>
<td>2-23</td>
</tr>
</tbody>
</table>
### 3 Selection of Chemicals of Potential Concern

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Target Chemical List</td>
<td>3-1</td>
</tr>
<tr>
<td>3.2 Review of Existing Soil, Sediment, and Water Data</td>
<td>3-2</td>
</tr>
<tr>
<td>3.2.1 Prior Studies</td>
<td>3-2</td>
</tr>
<tr>
<td>3.2.2 Data Usability</td>
<td>3-2</td>
</tr>
<tr>
<td>3.2.3 Terrestrial Environment</td>
<td>3-4</td>
</tr>
<tr>
<td>3.2.4 Streams</td>
<td>3-5</td>
</tr>
<tr>
<td>3.2.5 Tundra Ponds</td>
<td>3-6</td>
</tr>
<tr>
<td>3.2.6 Lagoons</td>
<td>3-7</td>
</tr>
<tr>
<td>3.2.7 Marine Environment</td>
<td>3-7</td>
</tr>
<tr>
<td>3.2.8 Comparison of Site Data with Reference Data</td>
<td>3-8</td>
</tr>
<tr>
<td>3.3 Human Health CoPC Screening</td>
<td>3-8</td>
</tr>
<tr>
<td>3.3.1 Terrestrial Environment</td>
<td>3-9</td>
</tr>
<tr>
<td>3.3.2 Freshwater Environment</td>
<td>3-14</td>
</tr>
<tr>
<td>3.3.3 Coastal Lagoon and Marine Environments</td>
<td>3-16</td>
</tr>
<tr>
<td>3.4 Selection of Human Health CoPCs</td>
<td>3-19</td>
</tr>
<tr>
<td>3.5 Ecological Screening Assessment</td>
<td>3-20</td>
</tr>
<tr>
<td>3.5.1 Terrestrial Tundra Environment</td>
<td>3-20</td>
</tr>
<tr>
<td>3.5.2 Streams</td>
<td>3-21</td>
</tr>
<tr>
<td>3.5.3 Tundra Ponds</td>
<td>3-22</td>
</tr>
<tr>
<td>3.5.4 Coastal Lagoons</td>
<td>3-23</td>
</tr>
<tr>
<td>3.5.5 Marine Environment</td>
<td>3-24</td>
</tr>
<tr>
<td>3.5.6 Wildlife</td>
<td>3-25</td>
</tr>
<tr>
<td>3.6 Selection of Ecological CoPCs</td>
<td>3-28</td>
</tr>
<tr>
<td>3.6.1 Media Screening Evaluations</td>
<td>3-29</td>
</tr>
<tr>
<td>3.6.2 Summary of Media Screening and CoPC Selection</td>
<td>3-30</td>
</tr>
<tr>
<td>3.6.3 Summary of Wildlife Screening and CoPC Selection</td>
<td>3-32</td>
</tr>
<tr>
<td>3.7 Data Gaps</td>
<td>3-34</td>
</tr>
</tbody>
</table>

### 4 Supplemental Data Collection for Risk Assessment

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Human Health – Subsistence Foods Data</td>
<td>4-1</td>
</tr>
<tr>
<td>4.2 Ecological Data</td>
<td>4-2</td>
</tr>
<tr>
<td>4.2.1 Terrestrial Assessment</td>
<td>4-2</td>
</tr>
<tr>
<td>4.2.2 Freshwater Aquatic Assessment</td>
<td>4-3</td>
</tr>
<tr>
<td>4.2.3 Coastal Lagoon Assessment</td>
<td>4-3</td>
</tr>
</tbody>
</table>
4.3 Marine Assessment and CoPC Screening 4-4

5 Human Health Risk Assessment 5-1

5.1 Refined Conceptual Site Model 5-1

5.2 Exposure Assessment 5-1
5.2.1 Exposure Concentrations 5-2
5.2.2 Subsistence Use 5-6
5.2.3 Combined Occupational and Subsistence Use 5-16

5.3 Toxicity Assessment 5-23
5.3.1 Antimony 5-24
5.3.2 Barium 5-24
5.3.3 Cadmium 5-25
5.3.4 Lead 5-27
5.3.5 Thallium 5-28
5.3.6 Zinc 5-29

5.4 Risk Characterization 5-30
5.4.1 Risk Estimates for the Subsistence Use Scenario 5-31
5.4.2 Risk Estimates for the Combined Worker/Subsistence Use Scenario 5-32
5.4.3 Uncertainty Assessment 5-33

6 Ecological Risk Assessment 6-1

6.1 Problem Formulation 6-1
6.1.1 Refinement of CoPCs 6-1
6.1.2 Complete Exposure Pathways 6-2
6.1.3 Refined Conceptual Site Model 6-4
6.1.4 Selection of Assessment Endpoints 6-4
6.1.5 Selection of Measurement Endpoints 6-6
6.1.6 Ecological Receptors 6-6

6.2 Terrestrial Assessment 6-11
6.2.1 Plant Community Surveys 6-11
6.2.2 Plant Tissue Comparisons with Phytotoxicity Thresholds 6-27
6.2.3 Risk Characterization for Terrestrial Plants 6-28
6.2.4 Risk Characterization for Tundra Soil Fauna 6-36

6.3 Freshwater Aquatic Life Assessment 6-37
6.3.1 Stream Invertebrate Community Analysis 6-37
6.3.2 Tundra Pond Invertebrate Assessment 6-43
6.3.3 Freshwater Aquatic Plant Community Assessment 6-44
6.3.4 Stream Fish Assessment 6-47

6.4 Coastal Lagoon Aquatic Life Assessment 6-49
  6.4.1 Coastal Lagoon Benthic Invertebrates Assessment 6-50
  6.4.2 Coastal Lagoon Plant Community Assessment 6-50

6.5 Wildlife Assessment 6-52
  6.5.1 Exposure Characterization 6-53
  6.5.2 Effects Characterization 6-57
  6.5.3 Toxicity Assessment 6-67
  6.5.4 Risk Characterization for Wildlife 6-74

6.6 Uncertainty Assessment 6-81
  6.6.1 Uncertainties Related to CoPC Screening 6-82
  6.6.2 Uncertainties Related to Terrestrial Assessment 6-82
  6.6.3 Uncertainties Related to the Wildlife Assessment 6-87

6.7 Interpretation of Ecological Significance 6-97
  6.7.1 Terrestrial Habitats 6-97
  6.7.2 Freshwater Habitats 6-99
  6.7.3 Coastal Lagoons 6-100

7 Calculation of Risk-Based Action Levels 7-1
  7.1 Human Health Based Action Levels 7-1
  7.2 Ecological Risk Based Action Levels 7-1
  7.3 Risk Management Plan 7-2

8 Conclusions 8-1
  8.1 Human Health Risk Assessment 8-1
    8.1.1 Child Subsistence Use 8-1
    8.1.2 Adult Subsistence Use 8-1
    8.1.3 Worker/Subsistence Use 8-2
  8.2 Ecological Risk Assessment 8-2
    8.2.1 Terrestrial Habitats 8-2
    8.2.2 Freshwater Streams 8-4
    8.2.3 Freshwater Ponds 8-4
    8.2.4 Coastal Lagoons 8-4

9 References 9-1
Appendix A  Summary of Phase I Sampling Program for the DMTS Fugitive Dust Risk Assessment
Appendix B  Data Quality Review for Phase I Sampling Program for the DMTS Fugitive Dust Risk Assessment
Appendix C  Inorganic Chemical Data Used in CoPC Screening
Appendix D  Organic Chemical Data
Appendix E  Summary of Phase II Sampling Program for the DMTS Fugitive Dust Risk Assessment
Appendix F  Data Quality Review for the Phase II Sampling Program for the DMTS Fugitive Dust Risk Assessment
Appendix G  Additional Data Used in the Risk Assessment
Appendix H  Subsistence Foods Data Evaluations
Appendix I  Vegetation Community Surveys
Appendix J  Photographs of Typical Biota Samples
Appendix K  Food Web Model Tables
List of Figures

Figure 1-1. Decision making framework for evaluating risk to human health and ecological receptors

Figure 1-2. Site location

Figure 1-3. Areas of zinc, lead, and barite mineralization in the western Brooks Range, Alaska

Figure 1-4. Mineralization map for the Red Dog mining district

Figure 1-5. Land ownership and use map

Figure 1-6. Port site storage and conveyance features map

Figure 2-1. Preliminary conceptual site model for the DMTS human health risk assessment

Figure 2-2. Preliminary conceptual site model for the DMTS ecological risk assessment

Figure 2-3. Vicinity map with topography

Figure 3-1. Station location map

Figure 3-2. Soil station locations (tundra and inorganic)

Figure 3-3. Sediment station locations (stream, tundra pond, lagoon, and marine)

Figure 3-4. Water station locations (stream, tundra pond, lagoon, and marine)

Figure 3-5. Human health screening results for barium in soil

Figure 3-6. Human health screening results for cadmium in soil

Figure 3-7. Human health screening results for lead in soil

Figure 3-8. Human health screening results for zinc in soil

Figure 3-9. Ecological screening results for cadmium

Figure 3-10. Ecological screening results for lead

Figure 3-11. Ecological screening results for zinc

Figure 4-1. Locations of terrestrial sample stations

Figure 4-2. Detailed views of locations of terrestrial sample stations

Figure 4-3. Locations of freshwater aquatic sample stations

Figure 4-4. Locations of coastal lagoon sample stations
Figure 4-5. Locations of marine sediment sample stations
Figure 4-6. Schematic layout of typical 10 m and 20 m terrestrial transect station
Figure 4-7. Schematic layout of typical 100 m, 1,000 m, and 2,000 m terrestrial transect station
Figure 4-8. Schematic layout of typical stream station
Figure 4-9. Barium in tundra soil and biota
Figure 4-10. Cadmium in tundra soil and biota
Figure 4-11. Lead in tundra soil and biota
Figure 4-12. Zinc in tundra soil and biota
Figure 4-13. Concentrations as a function of distance from the road (Transect TT8): a) pH and lead; b) normalized metals and pH
Figure 4-14. 2004 pre-shipping cadmium concentration (mg/kg dry)
Figure 4-15. 2004 pre-shipping copper concentration (mg/kg dry)
Figure 4-16. 2004 pre-shipping lead concentration (mg/kg dry)
Figure 4-17. 2004 pre-shipping mercury concentration (mg/kg dry)
Figure 4-18. 2004 pre-shipping silver concentration (mg/kg dry)
Figure 4-19. 2004 pre-shipping zinc concentration (mg/kg dry)
Figure 4-20. 2004 during-shipping cadmium concentration (mg/kg dry)
Figure 4-21. 2004 during-shipping copper concentration (mg/kg dry)
Figure 4-22. 2004 during-shipping lead concentration (mg/kg dry)
Figure 4-23. 2004 during-shipping mercury concentration (mg/kg dry)
Figure 4-24. 2004 during-shipping silver concentration (mg/kg dry)
Figure 4-25. 2004 during-shipping zinc concentration (mg/kg dry)
Figure 5-1. Refined conceptual site model for the DMTS human health risk assessment
Figure 5-2. Subsistence food samples used for the human health risk assessment
Figure 5-3. Fractional intake for Kivalina subsistence use area
Figure 5-4. Fractional intake for Noatak subsistence use area
Figure 6-1. Refined conceptual site model for the DMTS ecological risk assessment
Figure 6-2. Vascular plant canopy composition of terrestrial vegetation communities along the DMTS road: a) coastal plain mesic tussock tundra; b) foothills mesic tundra; c) hillslope mesic tundra

Figure 6-3. Representative example of coastal lagoon vegetation profile

Figure 6-4. Average percent cover and frequency of mosses and lichens in microplots at terrestrial survey stations: a) moss cover; b) lichen frequency; c) lichen cover

Figure 6-5. Factors 1 and 2 from principal component analysis of vegetation community variables

Figure 6-6. Factors 2 and 3 from principal component analysis of vegetation community variables

Figure 6-7. Composition of tundra soil invertebrate samples

Figure 6-8. Comparison of total abundance and percent dominance between site and reference stations

Figure 6-9. Comparison of total and EPT taxa richness between site and reference stations

Figure 6-10. Comparison of relative abundances of EPT taxa and chironomids between site and reference stations

Figure 6-11. Results of classification analysis of benthic macroinvertebrate drift assemblages

Figure 6-12. Ecological risk assessment stations used for the evaluation of large home-range receptors

Figure 6-13. Lichen stations in ecological assessment units

Figure 6-14. Moss stations in ecological assessment units

Figure 6-15. Sedge stations in ecological assessment units

Figure 6-16. Willow/birch stations in ecological assessment units

Figure 6-17. Small mammal stations in ecological assessment units

Figure 6-18. Tundra soil stations in ecological assessment units

Figure 6-19. Surface water stations in ecological assessment units

Figure 6-20. Food-web exposure modeling results for tundra vole

Figure 6-21. Food-web exposure modeling results for tundra shrew

Figure 6-22. Food-web exposure modeling results for muskrat

*Figures are presented at the end of the main text.*
List of Tables

Table 2-1. Composition of Red Dog lead and zinc concentrates
Table 2-2. DMTS-related spills from DEC database
Table 2-3. Relative importance of potential human exposure pathways
Table 2-4. Subsistence resource categories and representative receptors
Table 2-5. Summary of preliminary assessment endpoints, representative receptors, and measurement endpoints

Table 3-1. Target chemical list
Table 3-2. Overview of prior studies
Table 3-3. Analytical data summary for screening chemicals of potential concern
Table 3-4. Statistical comparison of site and reference soil data
Table 3-5. Statistical comparison of site and reference tundra soil data
Table 3-6. Statistical comparison of site and reference stream sediment data
Table 3-7. Statistical comparison of site and reference stream surface water data
Table 3-8. Statistical comparison of site and reference pond sediment data
Table 3-9. Statistical comparison of site and reference pond surface water data
Table 3-10. Statistical comparison of site and reference lagoon sediment data
Table 3-11. Statistical comparison of site and reference lagoon surface water data
Table 3-12. Statistical comparison of site and reference marine sediment data
Table 3-13. Statistical comparison of site and reference marine surface water data
Table 3-14. Human health screening results for surface soil
Table 3-15. Human health screening results for drinking water ingestion in stream surface water
Table 3-16. Human health screening results for fish consumption in stream surface water
Table 3-17. Human health screening results for lagoon water
Table 3-18. Human health screening results for marine surface water
Table 3-19. Ecological screening results for tundra soil
Table 3-20. Ecological screening results for stream sediment
Table 3-21. Ecological screening results for stream surface water
Table 3-22. Ecological screening results for tundra pond sediment
Table 3-23. Ecological screening results for tundra pond surface water
Table 3-24. Ecological screening results for lagoon sediment
Table 3-25. Ecological screening results for lagoon surface water
Table 3-26. Ecological screening results for marine sediment
Table 3-27. Ecological screening results for marine surface water
Table 3-28. Toxicity reference values used for wildlife screening and CoPC selection
Table 3-29. Ecological exposure assumptions for use in screening food-web models
Table 3-30. Screening-level food-web results for tundra vole
Table 3-31. Screening-level food-web results for river otter
Table 3-32. Screening-level food-web results for red-throated loon
Table 3-33. Screening-level food-web results for common snipe foraging in freshwater rivers and creeks
Table 3-34. Screening-level food-web results for common snipe foraging in tundra ponds
Table 3-35. Screening-level food-web results for black-bellied plover foraging in coastal lagoons
Table 3-36. Results of screening against lowest ecological screening benchmarks
Table 3-37. Results of statistical comparison with reference data
Table 3-38. Chemicals of potential concern retained for ecological risk analysis
Table 3-39. Data needs for the ecological risk assessment
Table 4-1. Overview of Phase II data
Table 4-2. Phase II data collection matrix
Table 5-1. Summary of exposure point concentrations for environmental media
Table 5-2. Summary of exposure point concentrations for subsistence foods
Table 5-3. Calculation of predicted fish thallium exposure point concentration
Table 5-4. Calculation of predicted caribou barium exposure point concentrations for kidney, liver, and muscle tissue
Table 5-5. Ptarmigan tissue weight calculations
Table 5-6. EPA IEUBK lead model exposure parameters and input values
Table 5-7. Bioavailability of lead in Red Dog concentrate
Table 5-8. Calculation of subsistence food lead intake for EPA IEUBK child lead model
Table 5-9. Exposure assumptions used to calculate risk for non-lead metals for adults in the subsistence use scenario
Table 5-10. Exposure assumptions used to calculate risk for non-lead metals for children in the subsistence use scenario
Table 5-11. Estimated subsistence food consumption rates
Table 5-12. Dietary intake of Alaska native adults
Table 5-13. Adult lead model exposure parameters
Table 5-14. Calculation of subsistence food lead intake for adult lead model
Table 5-15. Exposure assumptions used to calculate risk for non-lead metals for adults in the combined worker/subsistence user scenario
Table 5-16. Noncancer toxicity data—oral reference doses
Table 5-17. Results for adult lead model
Table 5-18. Noncancer hazards for adult subsistence soil ingestion
Table 5-19. Noncancer hazards for child subsistence soil ingestion
Table 5-20. Noncancer hazards for adult subsistence surface water ingestion
Table 5-21. Noncancer hazards for child subsistence surface water ingestion
Table 5-22. Noncancer hazards for adult subsistence caribou consumption
Table 5-23. Noncancer hazards for child subsistence caribou consumption
Table 5-24. Noncancer hazards for adult subsistence fish consumption
Table 5-25. Noncancer hazards for child subsistence fish consumption
Table 5-26. Noncancer hazards for adult subsistence ptarmigan consumption
Table 5-27. Noncancer hazards for child subsistence ptarmigan consumption
Table 5-28. Noncancer hazards for adult subsistence berry consumption
Table 5-29. Noncancer hazards for child subsistence berry consumption
Table 5-30. Noncancer hazards for adult subsistence sourdock consumption
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-31.</td>
<td>Noncancer hazards for child subsistence sourdock consumption</td>
</tr>
<tr>
<td>5-32.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user soil ingestion</td>
</tr>
<tr>
<td>5-33.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user surface water ingestion</td>
</tr>
<tr>
<td>5-34.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user caribou consumption</td>
</tr>
<tr>
<td>5-35.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user fish consumption</td>
</tr>
<tr>
<td>5-36.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user ptarmigan consumption</td>
</tr>
<tr>
<td>5-37.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user berry consumption</td>
</tr>
<tr>
<td>5-38.</td>
<td>Noncancer hazards for adult DMTS worker/subsistence user sourdock consumption</td>
</tr>
<tr>
<td>5-39.</td>
<td>Summary of total hazard indices for reasonable maximum exposure scenarios</td>
</tr>
<tr>
<td>6-1.</td>
<td>Refined assessment endpoints, representative receptors, and measurement endpoints</td>
</tr>
<tr>
<td>6-2.</td>
<td>Cover classes for quantifying percent cover of plant species</td>
</tr>
<tr>
<td>6-3.</td>
<td>Summary of $p$-values for site to reference comparison by vegetation community type</td>
</tr>
<tr>
<td>6-4.</td>
<td>Summary of parameter relationships with distance from DMTS road</td>
</tr>
<tr>
<td>6-5.</td>
<td>Summary of correlations among vegetation variables and soil parameters</td>
</tr>
<tr>
<td>6-6.</td>
<td>Summary of correlations among vegetation variables</td>
</tr>
<tr>
<td>6-7.</td>
<td>Summary of correlations among vegetation variables and soil parameters at coastal plain and tundra communities</td>
</tr>
<tr>
<td>6-8.</td>
<td>Summary of correlations among vegetation variables at coastal plain and tundra communities</td>
</tr>
<tr>
<td>6-9.</td>
<td>Summary of correlations between PCA factors and distance or soil characteristics</td>
</tr>
<tr>
<td>6-10.</td>
<td>Average percent cover and frequency results at coastal plain stations</td>
</tr>
<tr>
<td>6-11.</td>
<td>Average percent cover and frequency results at tundra stations</td>
</tr>
</tbody>
</table>
Table 6-12. Average percent cover and frequency results at hillslope stations
Table 6-13. Average percent cover and frequency results at coastal lagoon stations
Table 6-14. Vascular plant species diversity, evenness, and richness at terrestrial and coastal lagoon plant community survey stations
Table 6-15. CoPC concentrations, pH, and total solids in tundra soil at terrestrial and coastal lagoon plant community survey stations
Table 6-16. Comparison of CoPC concentrations in coastal lagoon sedge and grass samples against phytotoxicity thresholds reported in the literature
Table 6-17. Comparison of CoPC concentrations in unwashed willow and birch leaves against phytotoxicity thresholds reported in the literature
Table 6-18. Comparison of CoPC concentrations in unwashed sedge blades against phytotoxicity thresholds reported in the literature
Table 6-19. Summary of sampling characteristics for site and reference stations
Table 6-20. Summary of abundances of macroinvertebrates (per m³) in drift samples from site and reference stations
Table 6-21. Summary of benthic metrics at site and reference stations
Table 6-22. Comparison of CoPC concentrations in stream sedge and willow samples against phytotoxicity thresholds reported in the literature
Table 6-23. Comparison of CoPC concentrations in tundra pond sedge samples against phytotoxicity thresholds reported in the literature
Table 6-24. Metals concentrations in site and reference stream sediments and invertebrates
Table 6-25. Summary of water quality parameters for surface waters
Table 6-26. Food-web exposure model parameters
Table 6-27. Toxicity reference values for risk evaluation for wildlife receptors
Table 6-28. Food-web exposure modeling results for caribou
Table 6-29. Food-web exposure modeling results for Arctic fox

*Tables are presented at the end of the main text.*
List of Photographs

Photograph 1. Anxiety Ridge Creek
Photograph 2. Aufeis Creek
Photograph 3. Port Lagoon North
Photograph 4. Small tundra pond near port facilities
Photograph 5. Tundra pond
Photograph 6. Typical vegetation along the DMTS road
Photograph 7. Tussock tundra near the port facility
Photograph 8. Representative coastal plain mesic tussock tundra near station TT5-1000
Photograph 9. Coastal plain mesic tussock tundra at station TT5-2000
Photograph 10. Coastal plain reference station TS-REF-12
Photograph 11. Representative foothills mesic tussock tundra at transect TT8
Photograph 12. Foothills mesic tussock tundra at station TT8-1000
Photograph 14. Tall shrubs along the DMTS road at station TT8-0010
Photograph 15. Hillslope mesic open shrubland at stations TT6-0010 (foreground and TT6-0100 (background)
Photograph 16. Hillslope mesic open shrubland at station TT6-0100
Photograph 17. Hillslope reference station TS-REF-11
Photograph 18. Dry alpine tundra community at station TT7-0100
Photograph 19. Port Lagoon North station PLNL
Photograph 20. Reference Lagoon station CL-REF-1
Photograph 21. North Lagoon station NLK
Photograph 22. Control Lagoon station CL-REF-2
Photograph 23. Coastal dune community at North Lagoon station NLF
Photograph 24. Dust deposition and road gravel at station TT5-0010
Photograph 25. Impounded water along the DMTS road shoulder at station TT2-0010

Photograph 26. Stressed blueberry (*Vaccinium uliginosum*), Labrador tea (*Ledum palustre*), and crowberry (*Empetrum nigrum*) at station TT3-0100

Photograph 27. Blackened heather (*Cassiope tetragona*) in a snow accumulation area at station TT7-0010

Photograph 28. Bleached lingonberry (*Vaccinium vitis-idaea*) in a snow accumulation area at station TT7-0010

Photograph 29. Brown crowberry and bleached lingonberry at reference station TS-REF-5

Photograph 30. Bare ground showing dead mosses under dust at station TT3-0010

Photograph 31. Blackened *Peltigera* lichen at station TT2-0010

Photograph 32. *Peltigera* lichen at station TT3-1000

Photograph 33. Microplot 1 at station TT5-0010

Photograph 34. Microplot 1 at station TT5-0100

Photograph 35. Microplot 1 at station TT5-1000

Photograph 36. Microplot 1 at station TT5-2000

Photograph 37. Typical microplot at reference station TS-REF-12

Photograph 38. Typical microplot at reference station TS-REF-12

Photograph 39. Microplot 3 at station TT8-0010

Photograph 40. Microplot at station TT8-0200

Photograph 41. Microplot at station TT8-0600

Photograph 42. Microplot 3 at station TT8-1000

Photograph 43. Microplot 3 at reference station TS-REF-5

Photograph 44. Microplot 3 at reference station TS-REF-7

Photograph 45. Microplot 1 at station TT6-0010

Photograph 46. Microplot 1 at station TT6-0100

Photograph 47. Microplot 1 at station TT6-1000

Photograph 48. Microplot 1 at reference station TS-REF-11

Photograph 49. Aerial view of stressed vegetation to the northwest of CSB1
Photograph 50. Aerial view of stressed vegetation near the ion exchange treatment overflow ditch

Photograph 51. Aerial view of stressed vegetation between the southwest corner of CSB1 and the DMTS road

Photograph 52. Stressed vegetation area northwest of CSB1

Photograph 53. Stressed vegetation area northwest of CSB1

Photograph 54. Exposed rocks and dead vegetation northwest of CSB1

Photograph 55. Standing water and sedges at the edge of the stressed vegetation area northwest of CSB1

Photograph 56. Close-up of sedge tussock in stressed vegetation area northwest of CSB1

Photograph 57. Exposed soil and rock, dead tundra vegetation, and live cottongrass northwest of CSB1

Photograph 58. Frost-heave formation observed in the hills around the mine

Photograph 59. Station ACR-R in Anxiety Ridge Creek (upstream)

Photograph 60. Station ACR-R in Anxiety Ridge Creek (downstream)

Photograph 61. Station OR-R in the Omikviorok River (downstream)

Photograph 62. Station AC-R in Aufeis Creek (upstream)

Photograph 63. Station AC-R in Aufeis Creek (downstream)

Photograph 64. Station ST-REF-3 in Reference Stream 3 (downstream)

Photograph 65. Station ST-REF-5 in Reference Stream 5 (upstream)

Photograph 66. Station ST-REF-5 in Reference Stream 5 (downstream)

Photograph 67. Station ST-REF-6 in Reference Stream 6 (downstream)

Photograph 68. Tundra pond plant community at station TP3

*Photographs are presented at the end of the main text.*
<table>
<thead>
<tr>
<th>Acronyms and Abbreviations</th>
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Executive Summary

Purpose of the Risk Assessment

Elevated metals concentrations have been identified in tundra in areas surrounding the DeLong Mountain Regional Transportation System (DMTS), primarily as a result of deposition of fugitive dust originating from the DMTS corridor that is used to transport zinc and lead ore concentrates from the Red Dog Mine, which is operated by Teck Cominco Alaska Incorporated. The purpose of the DMTS fugitive dust risk assessment is to estimate possible risks to human and ecological receptors posed by current and future exposure to metals in soil, water, sediments, and biota in areas surrounding the DMTS, and in areas surrounding the Red Dog Mine ambient air/solid waste permit boundary. The risk assessment is part of the overall process in which the areas of fugitive dust deposition surrounding the DMTS are being evaluated (see the main text for a review of regulatory context). The results of the risk assessment will help risk managers to determine what additional actions may be necessary to reduce those risks.

What This Document Includes

This document is a draft of the risk assessment for the DMTS and the area outside of the Red Dog Mine ambient air boundary. The risk assessment document expands upon the risk assessment work plan previously submitted to the Alaska Department of Environmental Conservation (DEC) in February 2004 (Exponent 2004b), using the framework established in that document. The February 2004 work plan was a revised draft of the work plan previously produced in January 2003 (Exponent 2003b). The February 2004 work plan incorporated revisions based on comments (DEC 2003b) from individuals (e.g., village residents), non-governmental organizations (e.g., Trustees for Alaska, NANA Regional Corporation), and government agencies (e.g., DEC, Alaska Industrial Development and Export Authority, National Park Service) on the January 2003 work plan. DEC provided comments on the February 2004 work plan in April 2004 (DEC 2004a), and the work plan was approved with response to comments in October 2004 (Exponent 2004c; DEC 2004b). Revisions agreed to in the response to comments are incorporated into this document.

The major parts of the risk assessment document include the preliminary human health and ecological conceptual site models, which are presented and then refined based on the results of screening and selection of chemicals of potential concern (CoPCs). Human health and ecological risk calculations are presented, and the risk assessment results are summarized. Appendices to the document describe the Phase I and Phase II field programs conducted to provide data for the risk assessment, and present data used in the assessment.
Risk Assessment Results

The following subsections summarize the findings of the human health and ecological risk assessments.

Human Health Risk Assessment

In the human health risk assessment (Section 5), a site-specific risk assessment was conducted. The risk assessment evaluated exposure to DMTS-related metals through incidental soil ingestion, water ingestion, and subsistence food consumption under three scenarios: 1) Child subsistence use, 2) Adult subsistence use, and 3) Combined worker/subsistence use. The results from each of the scenarios are summarized below. Risks are necessarily expressed separately for lead and for the other (non-lead) metals because a different methodology is used to estimate lead exposure and risks, as described in Section 5.2.2.1.

Child Subsistence Use

- Using EPA’s integrated exposure uptake/biokinetic (IEUBK) child lead model (U.S. EPA 1996c), with the model default soil lead bioavailability of 30 percent, the model predicted a geometric mean blood lead level of 1.2 μg/dL, with a less than 0.0005 percent chance of exceeding the target blood lead level of 10 μg/dL.

- Using the site-specific soil lead bioavailability of 9.7 percent, the model predicted a geometric mean blood lead level of 1.1 μg/dL, with a less than 0.0005 percent chance of exceeding the target blood lead level of 10 μg/dL.

- The cumulative hazard index from non-lead CoPCs was 0.3, well below the target hazard index of 1.0.

- Assuming a fractional intake from the site as high as 33 percent, cumulative risk from non-lead CoPCs would not exceed the target hazard index of 1.0.

- Assuming 100-percent intake from the site (fractional intake=1.0), no single CoPC would have a risk exceeding the target hazard index of 1.0.

Adult Subsistence Use

- For subsistence use, lead risks were evaluated only for children, but this would also be protective of adult exposure (see results for lead summarized above for child subsistence use).

- The cumulative hazard index from non-lead CoPCs was 0.1, well below the target hazard index of 1.0.

- Assuming a fractional intake from the site as high as 90 percent, cumulative risk from non-lead CoPCs would not exceed the target hazard index of 1.0.
Assuming 100-percent intake from the site (fractional intake=1.0), no single CoPC would have a risk exceeding the target hazard index of 1.0.

**Worker/Subsistence Use**

- Using the adult lead model default soil lead bioavailability of 12 percent, the model predicted a geometric mean blood lead level in the fetuses of pregnant women of $1.7 \, \mu g/dL$, with a 0.9 percent chance of exceeding the target blood lead level of $10 \, \mu g/dL$.

- Using the site-specific soil lead bioavailability of 3.9 percent, the model predicted a geometric mean blood lead level in the fetuses of pregnant women of $1.6 \, \mu g/dL$, with a 0.7 percent chance of exceeding the target blood lead level of $10 \, \mu g/dL$.

- The cumulative hazard index from non-lead CoPCs was 0.07, well below the target hazard index of 1.0.

- Assuming 100-percent intake from the site (fractional intake=1.0), cumulative risk from non-lead CoPCs would not exceed the target hazard index of 1.0.

Overall, risks were well within acceptable limits. The results of the risk assessment, along with the results from the subsistence foods evaluations (Appendix H), support continued harvesting of subsistence foods without limitations. Although harvesting remains off-limits within the DMTS restricted areas, it should be noted that human health risks are not elevated even when data from the restricted areas are included in risk estimates.

**Ecological Risk Assessment**

In the ecological risk assessment (Section 6), a site-specific assessment was conducted to evaluate risk to ecological receptors inhabiting terrestrial, freshwater stream and pond, and coastal lagoon habitats. The risk conclusions for each habitat are summarized below.

**Terrestrial Habitats**

- Changes in vegetation community structure are observable within 100 m of the DMTS road and port facilities. These community shifts appear to be due, in part, to physical and chemical influences of the road and their effect on hydrology, soil chemistry, and plant vitality. Physical and chemical stresses are commonly found associated with gravel roads in tundra environments. The importance of CoPCs in fugitive dusts relative to physical stresses caused by the DMTS road in producing these changes cannot be determined based on the data available at this time.

- Differences between reference plant communities and plant communities beyond 100 m from the DMTS road, specifically the 2- to 4.5-fold decrease
in lichen cover, may be a result of fugitive dust deposition; however, road effects or natural variability in plant communities may also be contributing factors for this observed difference.

- In port facility areas, particularly in the area immediately downwind of Concentrate Storage Building 1 (CSB1), the presence of stressed and dead vegetation appears to be primarily related to fugitive concentrate dust deposition, but physical disturbance associated with construction of CSB1 may also have been a contributing factor.

- Herbivorous and insectivorous small mammals (e.g., voles and shrews) inhabiting tundra within 10-100 m of the DMTS road, near the port facilities, or near the mine’s ambient air/solid waste boundary showed incremental risk from exposure to aluminum and barium. However, exposures decreased to no-effects levels or were comparable to reference exposures beyond 100 m from the road and 1,000 m from the mine’s ambient air/solid waste boundary. These localized effects on individuals’ survival and reproductive performance are unlikely to translate into population-level effects (e.g., changes in abundance or distribution), given the limited spatial scale of the effects, and given uncertainties associated with toxicity reference value (TRV) derivation.

- Population-level effects to herbivorous birds (e.g., ptarmigan) are unlikely. The lowest observed adverse effects level (LOAEL) based hazard quotient for barium exposure near the mine was 1.1, but at all other locations barium exposure is below the level at which adverse effects are first expected, thus the likelihood of site-wide effects on herbivorous bird populations is very low.

- For caribou, no adverse effects are predicted for the vast majority of caribou that only pass through the site during migration. There is a low likelihood that individual caribou over-wintering in the mine area may experience adverse effects (reduced growth) from exposure to aluminum, as LOAEL-based hazard quotients ranged from 2.2 to 2.5 across the site, and were about 3-fold higher than comparable reference area hazard quotients. However, the aluminum TRV probably over-estimates toxicity of the relatively low solubility, low bioavailability forms of aluminum found in the assessment area. In addition, it is very unlikely that any individual-level growth effects, if occurring, would lead to population-level effects because of the very small proportion of the total herd that could possibly over-winter near the mine site.

- The likelihood of adverse population-level effects to other terrestrial wildlife, including large-bodied mammalian herbivores (e.g., moose), avian invertivores (e.g., Lapland longspur and snipe), and avian and mammalian carnivores (e.g., snowy owl and Arctic fox), is considered to be negligible.
Freshwater Streams

- Benthic macroinvertebrate drift assemblages indicated that the overall characteristics of the communities found in the site streams crossing the road were similar to reference streams.

- Fish monitoring studies have found no consistent evidence of a road-related effect on metals concentrations in fish upstream and downstream of the DMTS. Adverse effects to fish populations are not predicted.

- Metals concentrations in plants were generally within the range of reference concentrations and/or literature phytotoxicity thresholds.

- The likelihood of adverse population-level effects to wildlife foraging in streams, including avian and mammalian herbivores (e.g., green-winged teal, muskrat, and moose) and avian invertivores (e.g., common snipe), is considered negligible.

Freshwater Ponds

- Adverse effects are not predicted in tundra ponds along the DMTS road, or at distances greater than 100 m from facilities. For these ponds, CoPC concentrations in sediment are not expected to be toxic to benthic macrofauna based on toxicity test data for coastal lagoons, metals concentrations in plants were generally within the range of reference concentrations and/or below phytotoxicity thresholds, and food-web models indicate a very low likelihood of adverse population-level effects to herbivorous wildlife (e.g., green-winged teal and muskrat).

- Adverse effects may exist for invertebrates and plants in ephemeral ponds located within 100 m of the concentrate conveyor and other port facilities.

Coastal Lagoons

- Sediment toxicity tests indicated no effects to benthic invertebrates in lagoons, even when exposed to elevated CoPC concentrations in sediments from locations nearest to port facilities.

- Plant community structure was similar at site and reference lagoons. Natural variability among and within lagoon plant communities likely accounts for the few differences that were observed.

- The likelihood of adverse population-level effects to wildlife foraging in coastal lagoons, including herbivorous and invertivorous birds (e.g., brant and black-bellied plover), is considered negligible.
Where We Are in the Process, and What Comes Next

Upon submittal of this draft risk assessment to DEC, DEC will provide a public comment period. After comments are provided, a comment response and resolution process will be completed, and then the risk assessment will be finalized. During this time frame and following completion of the risk assessment, Teck Cominco will develop a proposed risk management plan, in consultation with DEC and other stakeholders. The risk management plan will identify actions needed to address risks identified by the risk assessment, and will define a long-term program to monitor changes in conditions.

The risk management plan will be developed in parallel with the completion of the risk assessment, through the remainder of 2005. The plan will evaluate risk management options within the general categories of institutional controls, engineering controls, monitoring, and remediation/restoration. The plan will identify the most appropriate combination of actions for management of risk in the short-term, and over the long-term life of the mine.

Action levels were not calculated at this time because risks are not significantly elevated. However, action levels could be one component of a risk management strategy (e.g., as a tool for risk management associated with monitoring and/or with Teck Cominco’s voluntary cleanup program). The potential need for and use of action levels will be further evaluated in the process of developing the risk management plan. If numerical action levels are determined to be needed, they will be calculated and included in the plan.

Development of the plan will be a collaborative process involving DEC and other stakeholders throughout the process of identifying and evaluating options, and determining an agreed upon course of action.